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International Patent Application No. PCT/EP03/11094
Applicant: Borealis Technology Oy

With reference to the written opinion dated July 23, 2004, we hereby file an amended set of claims and supply arguments in favor of inventive step and clarity of the claims.

1. Amendments

Enclosed is the amended set of claims 1 to 13 on which the further examination procedure should be based. The subject matter of claim 7 was inserted into claim 1. Claims 8 to 14 were renumbered accordingly.

2. Clarity

In the official communication the Examiner objected clarity of the term "nanofiller".

We submit that the term "nano" is generally understood as the scientific prefix "nano" and terms introduced with this prefix, as for example "nanofiller" are regarded as describing objects which have dimensions in the nanoscale. Furthermore, there is a clear definition of the term in the application on page 1, line 18 and on page 7, line 8. Therefore, we submit that the term "nanofiller" is clear for a person skilled in the art.

3. Novelty

In the official communication the Examiner objected novelty of claim 1 but acknowledged novelty of claim 7. Since the subject matter of claim 7 was incorporated into claim 1, we submit that the amended claim 1 is novel. The same holds for the amended claim 13 (former claim 14).

4. Inventive step

Prior art document D1 is regarded as closest prior art. It is an object of D1 to provide a polar group containing olefin copolymer having excellent adhesion properties to metals or polar resins and excellent compatibility therewith and a thermoplastic resin composition containing the copolymer.

The present application is directed to a polymer composition including a polar group containing olefin copolymer as well. The copolymer of the present application is prepared by directly polymerizing olefin monomers with comonomers comprising functional groups and not by a grafting process. The present application emphasizes the homogeneous nature of the composition which results in improved thermal and mechanical properties.

It is the object of the present application to provide a polymer composition comprising optionally a matrix polymer, a nanofiller and a polyolefin with functional groups, which has improved thermal and mechanical properties, i.e. mechanical strength and stiffness, temperature resistance, flame retardancy, and barrier properties (see e.g. page 3, second paragraph).

Above mentioned problems are solved by the present application, in particular by the subject-matter of claim 1.

The homogeneous nature of the particular polymer composition of the present invention is responsible for the improved properties. This homogeneous nature leads to improved thermal and mechanical properties such as higher density and crystallinity, and barrier properties of the polymer composition, e.g. to moisture and gases. Further improved properties are mechanical strength and stiffness, temperature resistance and flame retardancy. The improved properties are achieved by incorporation of a nanofiller which is a clay-based layered material. Afore said incorporation leads to a good dispersion of the filler layers in the polymer down to nanoscopic dimensions. Therefore, a very homogeneous nature of the

mixture is achieved, causing the above mentioned improved thermal and mechanical properties.

Such a composition is neither disclosed in D1, nor does the skilled person have any incentive from D1 to apply the composition of the present invention for solving the above mentioned problems. The subject-matter of the present application therefore involves an inventive step over D1.

Also prior art document D3 disclosed the use of a clay-based layered nanofiller. However, D3 discloses a composition containing a polyolefin which was prepared after polymerization by a grafting process. The drawbacks of the afore-mentioned grafting process are described in the present application and in D1 in detail. Therefore, the person skilled in the art would not have combined D1 and D3 in order to solve the problem of the present application since D3 discloses a grafting process and this would have been a step backwards.


Further on, the person skilled in the art would not have combined D2 and D1 since D2 discloses a grafting process as well. Still further, D2 does not disclose clay-based layered nanofillers. Therefore, a combination of D2 with D1 would not help to solve the problems of the present application.

In view of the arguments provided above we submit that claim 1 as presently on file involves an inventive step.

5. Summary and request

We believe that the claims submitted herewith meet the requirements of the PCT. Therefore, it is expected to receive a favorable preliminary examination report.

Respectfully submitted,


Dr. Bernhard Pillep

Enclosure

New set of claims

Claims

1. A polymer composition comprising
 - (A) optionally a matrix polymer,
 - (B) a nanofiller ~~and~~ *which is a clay-based layered material*
 - (C) a polyolefin with functional groups which has been prepared directly by polymerising olefin monomers with comonomers comprising functional groups using a single site catalyst.
2. A polymer composition according to claim 1, wherein the fraction of the comonomers with functional groups in polyolefin (C) is from 0.05 to 10 mol%, preferably from 0.1 to 5 mol% and still more preferred from 0.1 to 2 mol%.
3. A polymer composition according claims 1 or 2, wherein polyolefin (C) is a polyolefin with polar groups.
4. A polymer composition according to claim 3, wherein the polar comonomers used in the preparation of polyolefin (C) are monomers comprising a carbon-carbon double bond and an organic alcohol or acid group.
5. A polymer composition according to claim 4, wherein said comonomers comprise from 6 to 18 carbon atoms, and more preferably from 8 to 16 carbon atoms.
6. A polymer composition according to any of the preceding claims, wherein polyolefin (C) is a copolymer comprising ethylene and/or propylene monomers and comonomers with functional groups.

~~7. A polymer composition according to any of the preceding claims, wherein nanofiller (B) is a clay-based layered material.~~

7. ~~8.~~ A polymer composition according to claim ~~7~~¹ wherein nanofiller (B) has been intercalated with a quaternary ammonium compound containing intercalating agent.

8. ~~9.~~ A polymer composition according to any of the preceding claims, wherein matrix polymer (A) is a polyolefin.

9. ~~10.~~ A polymer composition according to claim ~~9~~⁸, wherein matrix polymer (A) is an ethylene or propylene homo- or copolymer.

10. ~~11.~~ A polymer composition according to any of the preceding claims, wherein polyolefin (C) is present in an amount of 1 to 100, preferably of 5 to 50 and still more preferred of 4 to 10 parts by weight per 100 parts by weight of the total composition.

11. ~~12.~~ A polymer composition according to any of the preceding claims, wherein nanofiller (B) is present in an amount of 1 to 15, preferably of 2 to 10 and still more preferred of 4 to 10 parts by weight per 100 parts by weight of the total composition.

12. ~~13.~~ A polymer composition according to any of the preceding claims, wherein the matrix polymer (A) is present in amount of from 0 to 98, preferably from 40 to 93 and still more preferred from 45 to 91 parts by weight per 100 parts by weight of the total composition.

13. ~~14.~~ Use of a polyolefin with functional groups which has been prepared by polymerising olefin monomers with comonomers comprising functional groups using a single site catalyst as a compatibiliser in a polymer composition comprising a matrix polymer and a nanofiller_x which is a clay-based layered material.